U. S. NAVAL SUBMARINE MEDICAL CENTER

Submarine Base, Groton, Conn.

REPORT NUMBER 578

PERSONAL FACTORS IN DENTAL DISEASE PREVENTION:

I.   A TEST TO MEASURE DENTAL HEALTH KNOWLEDGE

by

CDR William R. Shiller, DC, USN

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SUBMARINE MEDICAL RESEARCH LABORATORY

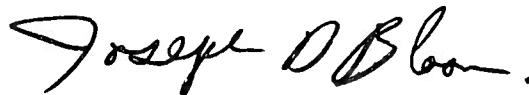NAVAL SUBMARINE MEDICAL CENTER REPORT NO. 578

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SUMMARY PAGE

THE PROBLEM

Much improvement is required in the personal oral hygiene of military personnel. The problem, however, is very complex and involves several factors including the individual's correct knowledge about his oral structures and about methods of prevention. An objective, valid evaluation method is required to determine the level of this knowledge in the individual.

FINDINGS

A dental health test has been developed which gives good response distribution to dental health knowledge questions. Scores from this test correlate significantly with the objectively evaluated oral health and hygiene status.

APPLICATIONS

The dental health test can be used in military preventive dentistry programs to determine the level of practical dental knowledge in a population, to evaluate the desired results of oral health lectures or other educational presentations, and to follow changes in oral health knowledge and concomitant oral health changes.

ABSTRACT

A dental health knowledge test was devised and was evaluated in 106 Submarine School students. Criteria of evaluation consisted of response distribution spreads, and objectively evaluated gingivitis and oral hygiene. A test score, derived from selected questions, was found to be significantly correlated with the objectively assessed health factors. It is concluded that the dental health knowledge test can be used in the Navy preventive dentistry studies.

PERSONAL FACTORS IN DENTAL DISEASE PREVENTION:
I. A TEST TO MEASURE DENTAL HEALTH KNOWLEDGE

INTRODUCTION

Preventive dentistry research often seems most closely concerned with things that the dental profession can do to the patient to prevent disease. To anyone who has worked for any time in preventive dentistry this area of professional factors soon seems easier and less frustrating than does its companion area: personal prevention factors. The importance of personal home care in dental disease prevention seems almost universally accepted. The close positive relationship between good personal oral hygiene and dental health has been documented in many studies (1, 2, 3, 4); yet almost one-half of the population of the United States brush their teeth only one time a day or less (5). Even in highly selected groups such as submariners almost one-half of the individuals brush routinely less than once a day (6).

This problem of getting people to practice effective oral hygiene is recognized by the dental profession. The military services are particularly aware of the problem, since dental care of military personnel probably represents the clearest extant example of true public health dentistry. That is, the dental health of each individual is of real concern to the military dentist whether or not that individual, personally, seems to be particularly motivated to maintain a healthy mouth. Small isolated crews such as submarine crews represent groups for which it becomes almost crucial to provide for complete dentistry including personal dental disease prevention. For this reason, a series of studies was planned to evaluate the total of personal disease preventive factors in the Atlantic submarine force.

Proper personal oral hygiene depends upon the patient's being **motivated** to do those things that he has the **knowledge** to do, that are reasonably within his **dexterity** and **equipment** limits. It is the opinion of this worker that this listing places the factors very nearly in their proper order of importance. Each factor is worthy of special

consideration, however, and this paper is concerned with the knowledge factor only.

There is, unfortunately, great lack of agreement among dentists concerning some of the specifics in personal oral hygiene programs. This is one of the first difficulties encountered when attempting to develop educational programs for oral health. There have been some attempts made to present detailed understandable information to the public (7, 8); however, very little objective evaluations of the effectiveness of this education has been made. Muhler (9) has devised a dental "I.Q." test to discover knowledge of dental health and to discover relationships between this knowledge and oral health in school children. His initial promising results gave impetus to the present study in which an attempt is made to devise a test for measuring the subject's knowledge of oral health factors and to provide a tool for assessing the role of this factor in an oral hygiene motivation program in submariners.

MATERIALS AND METHODS

With the assistance of the staff of the Personnel Assessment Branch of the Submarine Medical Research Laboratory, a preliminary test was formulated (Appendix I). It must be admitted that these questions were somewhat arbitrary and reflected the bias of the investigator. There was a method to the question formulation, however, in that they were designed to elicit responses in keeping with some of the respected present thinking of dental science and they were designed to discover knowledge in five important areas. Questions 1 through 5 were concerned with basic knowledge of dental anatomy and physiology; questions 6 through 11 concerned the causes of dental caries; questions 12 through 18 concerned the cause of periodontal disease; questions 19 through 22 concerned professional preventive measures; and questions 23 through 30 concerned personal preventive measures. This preliminary test was evaluated by the staff of the

Submarine Base Dental Department, and was given to 88 Submarine School students at the time of their dental examination. This examination included a debris score derived after the method of Greene and Vermillion (10). The results were evaluated and obviously inappropriate questions were discarded and some of the remaining ones were reworded to elicit clear responses.

The refined Dental Health Test (Part 1) (Appendix 2) consisted of 19 questions again arranged in five areas: Anatomy and physiology, caries etiology, periodontal disease etiology, professional preventive measures, and personal preventive measures.

This test was administered to 106 new Submarine School students. Their gingival condition was assessed by the periodontal index of Russell (11) and oral hygiene again was assessed by the method of Greene and Vermillion (10).

RESULTS AND DISCUSSION

The mean periodontal index and the mean debris score are given in Table I. The study sample is seen to be within the limits previously reported for the Submarine School population (4).

Tables II and III give the responses to those questions requiring a positive or negative answer and the mean periodontal indices and debris scores for each group of responders. First of all, it is noted that with the exception of questions 3, 9, 14 and 15, there was a fairly even distribution between the responses. It should then be noted that none of the oral health measurement's means between response groups were significantly different for any of these questions. There were several questions, however, in which trends were noted.

The responses to several questions merit some discussion. It is most interesting that 93% of the men do not believe that the teeth are self-cleaning (question 3). This response was somewhat surprising in view of the recurring stress placed on finishing a meal with rough foods in those instances where brushing is impossible. The responses to questions 14 and 15 evidently indicate that most individuals have been thoroughly "brainwashed" concerning the one right way to brush is as the teeth grow.

Tables IV, V, VI, VII, and VIII contain data from those questions presenting multiple choices. It is somewhat discouraging to note that only 12% of the men knew that the main action of fluorides (Table IV) was decreasing the solubility of the tooth, but it should be noted that this 12% had significantly cleaner teeth than did the other responders. It is certainly gratifying that no one thought that a professional prophylaxis was done to make the teeth white (Table V).

The individual's criteria of effectively brushed teeth seemed to have some relationship to the objectively evaluated oral health. The men who believed that the proper criterion is shiny and white, had more gingivitis and plaque than did the other two responder groups. It is very gratifying to note that a large majority of the subjects believed that removing the bacterial plaque was the best way to prevent both decay and periodontal disease (Table VII). The opinions concerning the best time to brush were not dramatically related to the evaluated oral health factor.

The usefulness of a dental health test in public health would probably be slight if for each group assessment each question would have to be examined in detail. For this reason a total score was derived based on the number of "right" answers. These answers are noted by blocks in Appendix 2. Actually, some dentists might quarrel with some of these as merely representing one investigator's bias. This is admitted in part, but again, these "right" responses are the salient point of a typical oral health lecture. In this cross-sectional study essentially no correlation was found between the total mean score and the levels of oral health (Table IX).

There were six questions (questions 1, 6, 7, 10, 12 and 16) which show at least a negative trend between "right" responses and the periodontal index and debris scores in this cross-sectional study. A score of the number of these questions that were missed was derived and was then compared with the oral examination results (Table IX). It is seen

that there is a weak, but significant correlation between these selected question scores and the gingivitis and debris levels. These relationships are depicted in a different manner in Figures 1 and 2. The points on these graphs represent the means and the limits are the standard errors of the mean. Thus we see that the subjects who "missed" the smaller number of these selected questions also tended to have the lower amounts of peridontal disease and plaque.
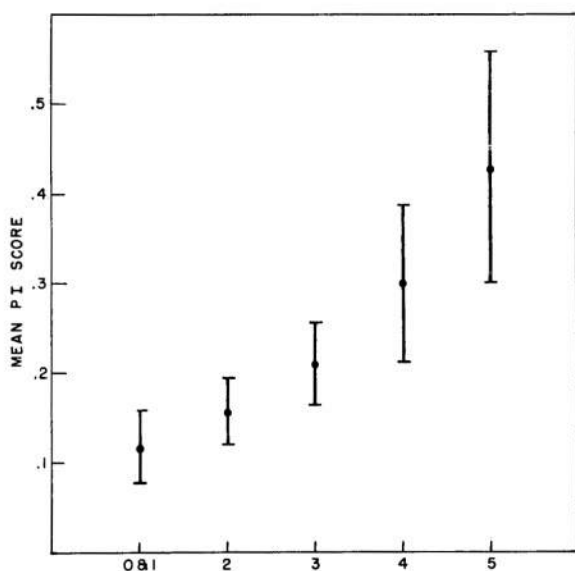

Fig. 1. Selected Test Factor Score — PI Relationship.

CONCLUSION

It is doubtful that anyone would expect to find a dental knowledge questionnaire which would yield near exact relationships to oral health, particularly in a random cross-sectional survey. The fact that selected question responses could be significantly related to objectively evaluated health factors certainly gives promise of such a questionnaire being a valuable tool in the following manners:

1. To determine the level of practical dental knowledge in a population.

2. To evaluate the desired results of oral health lectures or other educational presentations.
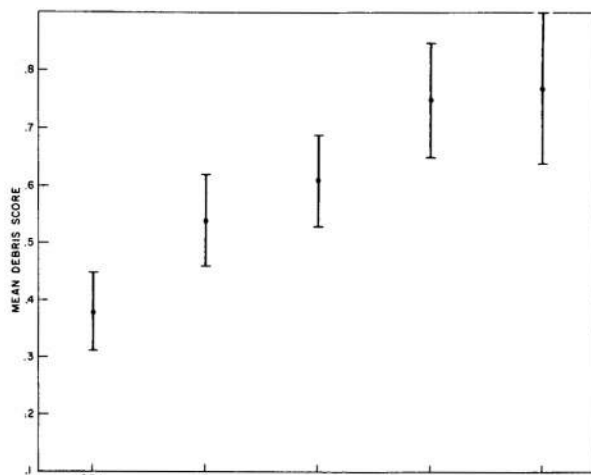
Fig. 2. Selected Test Factor Score — Debris Relationship.

3. To follow changes in oral health knowledge and concomitant oral health changes.

It is not too difficult to imagine that this test and companion tests of attitude and motivation could be used on very large groups. The test was designed to be employed with answer sheets that could readily be scored on automatic scoring machines.

It must be pointed out as a final note that re-validation of the test must be accomplished before any definite inferences can be drawn concerning its universal usefulness.

ACKNOWLEDGEMENTS

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Table 1

Group Dental Characteristics

Factor	N	Mean Score
Periodontal Index	106	0.23 ± 0.030*
Debris Score	106	0.62 ± 0.045

*Standard error of the mean.

Table 4

Knowledge of Fluoride Action Related to Oral Health

Question 12 responses

Oral health factor	N	Neutralizes the acids	Makes tooth less soluble	Kills bacteria on tooth	Forms a protective film	Don't know
Gingivitis	105	(13).33 ± .163	(13).21 ± .05	(8).19 ± .058	(71).21 ± .03	(0)
Debris	105	(13).77 ± .217	(13).43 ± .078	(8).75 ± .125	(71).63 ± .054	(0)

Table 5

Opinions Concerning Main Reasons for Professional Prophylaxes

Question 13 responses

Oral health factor	N	To make teeth white	To remove rough deposits	To remove bacterial plaque
Gingivitis	102	0	(65) .25 ± .041	(37) .17 ± .031
Debris	102	0	(66) .61 ± .057	(36) .64 ± .079

Table 2

Questionnaire Response and Gingivitis Relationship

Response

Factor	N	Positive		Negative		Don't know	
Question 1	106	(59)*	$.19^+ \pm .038^{++}$	(35)	$.28 \pm .059$	(12)	$.24 \pm .095$
Question 2	106	(34)	$.27 \pm .057$	(48)	$.22 \pm .051$	(24)	$.19 \pm .04$
Question 3	106	(8)	$.25 \pm .058$	(98)	$.23 \pm .033$		
Question 4	106	(54)	$.25 \pm .044$	(52)	$.21 \pm .043$		
Question 5	106	(42)	$.25 \pm .057$	(64)	$.21 \pm .035$		
Question 6	106	(63)	$.27 \pm .042$	(43)	$.17 \pm .043$		
Question 7	106	(63)	$.25 \pm .044$	(43)	$.20 \pm .04$		
Question 8	105	(80)	$.23 \pm .037$	(25)	$.21 \pm .058$		
Question 9	106	(15)	$.26 \pm .122$	(91)	$.21 \pm .028$		
Question 10	106	(39)	$.27 \pm .067$	(67)	$.20 \pm .029$		
Question 11	106	(65)	$.22 \pm .039$	(41)	$.24 \pm .052$		
Question 14	106	(91)	$.23 \pm .03$	(15)	$.23 \pm .124$		
Question 15	106	(97)	$.22 \pm .033$	(7)	$.37 \pm .157$	(2)	
Question 18	106	(66)	$.24 \pm .045$	(40)	$.22 \pm .039$		

( )* Number of such responses

[+] Mean Periodontal Index

[++] Standard error of the mean.

Table 3

Questionnaire Response and Debris Relationships

Factor	N	Response Positive		Negative		Don't know	
Question 1	105	(59)	.62 ± .064	(34)	.63 ± .08	(12)	.49 ± .08
Question 2	105	(34)	.60 ± .09	(47)	.62 ± .074	(24)	.61 ± .058
Question 3	105	(8)	.67 ± .194	(97)	.61 ± .046		
Question 4	105	(53)	.62 ± .055	(52)	.61 ± .072		
Question 5	105	(42)	.64 ± .082	(63)	.59 ± .051		
Question 6	105	(62)	.67 ± .063	(43)	.53 ± .06		
Question 7	105	(63)	.65 ± .058	(42)	.56 ± .072		
Question 8	105	(78)	.61 ± .053	(27)	.63 ± .084		
Question 9	105	(15)	.69 ± .134	(90)	.60 ± .047		
Question 10	105	(39)	.62 ± .072	(66)	.61 ± .058		
Question 11	105	(64)	.60 ± .058	(41)	.61 ± .07		
Question 14	105	(91)	.63 ± .049	(14)	.56 ± .137		
Question 15	105	(97)	.60 ± .045	(6)	.63 ± .20	(2)	
Question 18	105	(66)	.62 ± .06	(39)	.61 ± .072		

Responses to Question 17

Oral health factor	N	Removal of bacterial plaque	When teeth are shiny and white	When gums bleed slightly
Gingivitis	106	(59) .19 ± .033	(33) .35 ± .077	(14) .16 ± .036
Debris	105	(59) .56 ± .057	(32) .78 ± .105	(14) .58 ± .08

Response to Question 17

Oral health factor	N	Topical fluorides	Restrict refined sugars	Remove bacterial plaque
Gingivitis	106	(29) .20 ± .039	(5)	(72) .22 ± .035
Debris	105	(28) .57 ± .079	(5)	(72) .61 ± .054

Responses to Question 19

Oral health factor	N	After eating	At best convenient time	No opinion
Gingivitis	106	(66) .20 ± .032	(36) .28 ± .068	(4)
Debris	105	(66) .63 ± .058	(35) .60 ± .084	(4)

Score methods	N	Mean score	Correlations (r)	
			Gingivitis	Debris
Total score (examiner criteria)	103	8.98 ± 2.28*	-.06	-.15
Selected questions score	103	3.02 ± 1.19	+.27	+.25

*Standard deviation

DENTAL HEALTH TEST

Circle one answer only

1. The crown of the tooth is covered by a hard substance called

    a. dentin   b. cementum   c. enamel

2. There is normally a shallow trough (space) between the gums and the tooth surface.

    a. yes   b. no   c. don't know

3. The normal tooth moves slightly in its socket when you chew your food.

    a. yes   b. no   c. don't know

4. The hard surface of the tooth is primarily composed of minerals arranged in crystals.

    a. yes   b. no   c. don't know

5. The teeth and gums are naturally self-cleansing in the normal condition.

    a. yes   b. no   c. don't know

6. Dental decay starts because acids dissolve the tooth substance.

    a. yes   b. no   c. don't know

7. Bacteria on your teeth produce acids from the food you eat.

    a. yes   b. no   c. don't know

8. Your teeth can decay even if all the bacteria are removed from them.

    a. yes   b. no   c. don't know

9. A well established bacterial plaque (mass of germs) must be present to cause dental decay.

    a. yes   b. no   c. don't know

10. Large food particles left on your teeth after eating are the chief causes of tooth decay.

    a. yes   b. no   c. don't know

11. Once decay starts, it can not be stopped except by having a filling put in the tooth.

    a. yes   b. no   c. don't know

12. Periodontal disease (gum disease) is caused by calculus (tartar) on your teeth.

    a. yes   b. no   c. don't know

13. Pyorrhea is contagious (catching).

    a. yes   b. no   c. don't know

14. Peridontal diseases (gum diseases) are usually bacterial infections.

    a. yes   b. no   c. don't know

15. If bone support is lost around a tooth it will usually grow back with proper treatment.

    a. yes   b. no   c. don't know

16. Periodontal disease (gum disease) only rarely is found in a person under 30 years of age.

    a. yes   b. no   c. don't know

17. Too many sweets cause most periodontal disease (gum disease).

    a. yes   b. no   c. don't know

18. Vincent's infection (trench mouth) is usually caught from a cup or glass that was used by an infected individual.

    a. yes   b. no   c. don't know

19. Fluorides are most effective in preventing

    a. dental decay
    b. periodontal disease (gum disease)
    c. trench mouth
    d. don't know

20. Having fluorides applied to your teeth does the following

    a. neutralizes the acids produced by bacteria
    b. makes the tooth surface less soluable
    c. kills the bacteria present on the teeth
    d. forms a protective film over the teeth
    e. don't know

21. Topical fluorides (fluoride solutions placed on your teeth) should be applied

    a. only once
    b. at least every year
    c. don't know

22. The main reason the dentist cleans your teeth is

    a. to make them white
    b. to remove calculus (tartar) and other rough deposits
    c. to remove the bacterial plaque that you miss
    d. don't know

23. There is only one really correct way to brush your teeth.

    a. agree   b. disagree

24. The teeth must be brushed in the direction they grow—down on the uppers, up on the lowers.

    a. agree   b. disagree   c. no opinion

25. Dental floss is necessary to clean between the teeth.

    a. agree   b. disagree   c. no opinion

26. You know you have properly cleaned your teeth when

    a. you have removed all bacterial plaque (soft material) from the teeth
    b. your teeth are shiny and white
    c. your gums just begin to bleed slightly

27. The bacterial plaque is always

    a. easily seen in the natural state
    b. is made visible by a disclosing dye

28. The only way to prevent both tooth decay and periodontal disease (gum disease) at the same time is

    a. by having topical fluorides applied to your teeth once each year
    b. by cutting out refined sugars from your diet
    c. by keeping the bacterial plaque (soft material) off your teeth

29. Rinsing the mouth with water after eating is an effective means for preventing dental decay and periodontal disease (gum disease).

    a. agree   b. disagree

30. To be effective the teeth must be brushed and flossed

    a. immediately after eating
    b. any convenient time when a thorough job can be done
    c. no opinion

31. Dental decay is contagious (catching).

    a. agree   b. disagree   c. no opinion

DENTAL HEALTH TEST (Part 1)

Circle one answer only

1. There is normally a shallow trough (space) around each tooth between the gums and the tooth surface.

    a. agree   b. disagree   c. don't know

2. The hard surface of the tooth is mainly made of minerals arranged in crystals.

    a. agree   b. disagree   c. don't know

3. Normal teeth and gums are naturally self-cleansing and do not really require brushing if enough rough foods are eaten.

    a. agree   b. disagree

4. Teeth can decay even if no bacteria are on them.

    a. agree   b. disagree

5. A well established bacterial plaque (mass of germs) must be present if the teeth are to decay.

    a. agree   b. disagree

6. Once decay starts, it can not be stopped except by having a filling put in the tooth.

    a. agree   b. disagree

7. Peridontal disease (gum disease) is caused by calculus (tartar) on your teeth.

    a. agree   b. disagree

8. Periodontal diseases (gum diseases) are really bacterial infections.

    a. agree   b. disagree

9. Periodontal disease (gum disease) only rarely is found in a person under 30 years of age.

    a. agree   b. disagree

10. Too many sweets cause most periodontal disease (gum disease).

    a. agree   b. disagree

11. Vincent's infection (trench mouth) is usually caught from a cup or glass that was used by an infected individual.

    a. agree   b. disagree

12. Having fluorides applied to your teeth mainly does one of the following:

    a. neutralizes the acids produced by bacteria
    b. makes the tooth surface less soluble
    c. kills the bacteria present on the teeth
    d. forms a protective film over the teeth
    e. don't know.

13. The main reason the dentist cleans your teeth is

    a. to make them white
    b. to remove calculus (tartar) and other rough deposits
    c. to remove the bacterial plaque that you miss.

14. There is only one really correct technique to brush your teeth.

    a. agree   b. disagree

15. The teeth must be brushed in the direction they grow—down on the uppers, up on the lowers.

    a. agree   b. disagree   c. no opinion

16. You know you have properly cleaned your teeth when

    a. you have removed all bacterial plaque (soft material) from the teeth
    b. your teeth are shiny and white
    c. your gums just begin to bleed slightly.

17. The only way to prevent both tooth decay and periodontal disease (gum disease) at the same time is

    a. by having topical fluorides applied to your teeth once each year
    b. by cutting out refined sugars from your diet
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    a. agree   b. disagree

19. To be effective the teeth must be brushed

    a. immediately after eating
    b. at any convenient time when a thorough job can be done
    c. no opinion.

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13. ABSTRACT

A dental health knowledge test was devised and was evaluated in 106 Submarine School students. Criteria of evaluation consisted of response distribution spreads, and objectively evaluated gingivitis and oral hygiene. A test score, derived from selected questions, was found to be significantly correlated with the objectively assessed health factors. It is concluded that the dental health knowledge test can be used in the Navy preventive dentistry studies.

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